Juvenile Muskellunge Electrofishing Assessments

Statewide Muskie Management

Project #204031

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EXECUTIVE SUMMARY

Electrofishing was conducted on 43 occasions during spring and fall at 14 waters in Indiana between 2004 and 2006 to determine whether sufficient numbers of juvenile muskies (age-1 and age-2) could be captured to assess stocking success. However, few muskies were captured by electrofishing during either season at any water. No age-1 muskies were captured on at least one occasion at five waters in spring and nine waters in the fall. Ten waters provided no age-2 muskies. Only Ball Lake provided more than one age-2 muskie. The average electrofishing catch rate of age-1 muskies decreased from 3.93 per hour in spring to 0.35 per hour in fall and declined to 0.22 per hour for age-2 muskies in spring and 0.15 per hour in the fall. Based on results of this project, not enough juvenile muskies can be captured using standard electrofishing techniques to make reliable comparisons of age-1 and age-2 muskie survival within and among various Indiana waters.

INTRODUCTION

Lack of a standard protocol for sampling muskellunge *Esox masquinongy* has limited comparisons of muskie stocking success at various Indiana waters. Although trap nets have been used to capture adult muskies at Lake Webster for hatchery needs, the traps have been used rarely (Pearson 2005a, 2005b) at other muskie waters because they are expensive to purchase, cumbersome to move, labor intensive, and require extensive shallow flats to be fully set. Due to their large mesh size, the traps also fail to catch juvenile muskies, age-1 through age-3, thereby forcing managers to delay evaluations of stocking success or adjustments in stocking strategies until the fish are recruited into the adult population. Consequently, an alternative method is needed to readily assess muskie stockings and avoid the loss of time and money where muskie survival may be low.

Some authors have suggested that electrofishing can be an effective tool to sample young muskies. In Michigan, biologists have reportedly adopted a guideline of one to four age-1 muskies captured per mile of electrofishing in late fall as an average index of abundance (Ziegler and Schneider 2000). Likewise, other biologists have also caught young muskies with electrofishing gear, although mainly age-0 fish soon after stocking (Johnson and Margenau 1993, Wahl 1999). However, early attempts to capture juvenile muskies in Indiana with electrofishing gear were generally ineffective, although not adequately documented. In most cases, poor catches were attributed to low survival of small fingerlings reared entirely on food pellets. In contrast, Indiana biologists now stock large muskie fingerlings (10-12 in) reared initially on pellets but then fed live minnows for 30 or 90 days before release with the expectation that minnow-fed fingerlings will survive better. Although 30-day minnow-fed fish are less expensive to produce than 90-day fish, questions have also arisen over whether they survive as well. As a result, interest has rekindled in determining whether electrofishing can be used to capture sufficient numbers of minnow-fed muskies to assess their survival at a young age. If electrofishing is effective, plans are to compare post-stocking survival of 30-day fingerlings with 90-day fingerlings in hopes of maximizing efficiency of the stocking program. The purpose of this project is to re-examine whether electrofishing gear can be used to capture sufficient numbers of age-1 and age-2 minnow-fed muskies in the fall or spring in order to evaluate early survival of various muskie stocks.

METHODS

Electrofishing was conducted during spring and fall on 43 occasions between 2004 and 2006 at 14 Indiana muskie waters (*Table 1*), including seven natural lakes (Ball, Barbee, Bruce, Loon Skinner, Tippecanoe, Webster), three manmade impoundments (Glenn Flint, Palestine, Waveland), and four pits (Bass, BlackCat, Plover, Sandpiper). BlackCat and Waveland were first stocked in fall 2004 and were not expected to contain age-2 muskies until spring 2006, while Glenn Flint was first stocked in fall 2005, so only age-1 muskies were present in spring 2006. The other waters, except Tippecanoe, were stocked before 2004 at a typical rate of five fingerlings per acre, and were expected to contain age-1 or age-2 muskies when sampled. Lake Tippecanoe is stocked at the rate of one fingerling per acre. These 14 waters, in addition to Brookville Reservoir, include all Indiana waters currently stocked with muskies by the Division of Fish and Wildlife.

A boat-mounted, pulsed DC electrofishing Smith-Root® unit using one or two "dippers" to capture stunned fish was operated at night along the entire shoreline at small water or randomly chosen shoreline areas at large lakes. Water temperature at the time of sampling varied from 34-65F and averaged 52F during spring and 44F during fall. Electrofishing effort varied from 0.58 hours (Sandpiper) to 4.00 hours (Barbee) on each sampling occasion. As many stunned muskies as possible were netted and measured. Although scale samples were taken for age analysis, ages were primarily assigned to each fish based on length-frequency distributions and typical muskie growth rates in Indiana.

RESULTS

Few juvenile muskies were captured by electrofishing in spring or fall (*Table 1*), although at least one age-1 or age-2 muskie was captured at 13 of the 14 waters. None were captured at Tippecanoe. The number of age-1 muskies captured per occasion ranged from 0 to 41, while the number of age-2 muskies captured per occasion ranged from 0 to 10. Five waters provided no age-1 muskies on at least one occasion in spring (Barbee, Palestine, Plover, Skinner, Tippecanoe), while nine waters provided no age-1 muskies on at least one occasion in fall (Ball, Bass, Bruce, Palestine, Plover, Sandpiper, Tippecanoe, Waveland, Webster). Ball, Bass and Loon provided more than 10 age-1 muskies but only during spring sampling. Only one age-2 muskie was captured on four occasions, three of

which were in spring, at three lakes (Bass, Loon, Skinner). Ball Lake was the only water to provide more than one age-2 muskie. No age-2 muskies were caught at the other 10 waters.

The average number of age-1 muskies captured per hour of electrofishing was 3.93 in spring (n = 28) and 0.35 in fall (n = 15). Catch rates of age-2 muskies averaged 0.22 per hour in spring (n = 25) and 0.15 in fall (n = 14). Likewise, the average catch rate of age-3 and older muskies was 3.53 per hour in spring (n = 23) but only 0.42 in the fall (n = 14). The maximum catch rate of age-1 muskies (26.62/hr) occurred at Bass Pit in spring 2004 and the maximum catch rate of age-2 muskies (3.33/hr) occurred at Ball Lake in spring 2004. Fewer than four age-1 muskies were captured per hour on 35 of the 43 occasions and the catch rate of age-2 muskies was less than one per hour on all but three occasions.

DISCUSSION

Based on results of this project, not enough juvenile muskies can be captured using standard electrofishing techniques to make reliable comparisons of age-1 and age-2 muskie survival within or among various Indiana waters. Furthermore, there is nothing in the results to indicate the technique is any more applicable than what was demonstrated previously (*Table 2*). Although sampling in spring after a fall release may provide data on over-winter survival of stocked muskies to age-1, the information may be of little value in predicting long-term muskie survival or comparing survival from lake to lake. For example, inaccuracies in estimates of recruitment were partially responsible for the lack of a correlation between stocking and numbers of adult muskies in Wisconsin (Lyons and Margenau 1986). In addition, while it may be interesting to speculate that the drop in electrofishing catch rates of age-1 muskies from spring (3.93/hr) to fall (0.35/hr) and the decline of age-2 muskies the following spring (0.22/hr) and fall (0.15/hr) reflect mortality, the fact that electrofishing catch rates were also low where sizable adult populations have developed (e.g. Webster) more likely indicates a lack of vulnerability to sampling gear.

Although sampling effort for this project was recorded in units of time and not distance, it apparent that few waters other than perhaps Ball (1.33/hr) and Skinner

(1.77/hr) in 2004 would have likely met the Michigan standard of one or more age-1 muskies captured per mile during fall. Indiana biologists normally cover slightly more than a mile of shoreline during one hour of electrofishing, so catch rates per mile would probably have been less than catch rates per hour. Even so, catches of age-1 muskies in the fall at Ball and Skinner in 2004 included only two fish at each lake. It is hard to imagine anyone would assume such low catches at Ball and Skinner were indicative of better survival than even smaller catches at other waters.

Upon further literature review, it is also more apparent that few studies of muskie survival have been published where electrofishing has been used to sample muskies beyond the first few months after release. For example, where researchers were interested in comparing survival of pellet-fed versus minnow-fed fingerlings, they relied on the use of gill nets during the spawning run to capture them as age-3 and older fish (Larscheid et. al. 1999). In Ohio, survival of age-0 stocked muskies was monitored by electrofishing at 17 lakes only from September through December and catch rates varied from 0 to less than 15 per hour. Over half of the catch rates were less than 5 per hour (Wahl 1999). Evaluations of muskie stocking sizes and rearing methods in New York were based on catch rate analyses of age-5 fish. Researchers there warned that assessments based on short-term survival are inherently limited because mortality rates may change drastically within the first two years after stocking (McKeown et. al. 1999). In a muskie diet study in Wisconsin, Bozek et. al. (1999) used electrofishing, as well as fyke nets and angling, to capture muskies but did not report the number captured by each method.

Where electrofishing was used to assess survival of stocked muskies for several years, muskie catches also reportedly decreased among age-1 muskies from spring to fall and among age-2 muskies from spring to fall. Serns and Andrews (1986) caught 1,164 age-0 muskies from two cohorts in the first few months after release at four Wisconsin lakes, but the catch then declined to 442 age-1 fish by the first spring to 142 age-1 fish the following fall and 81 age-2 fish the following spring. Only 33 age-2 muskies were captured in the fall, representing a 97% reduction of the initial stock two years after release. Using these figures, survival from age-1 to age-2 was 18% (81/442) and survival within two growing seasons after age-1 was only 7% (33/442). Based on electrofishing

catch rates in our study, average muskie survival from age-1 to age-2 was only 6% (0.22/3.93) and survival within two growing seasons after age-1 was only 4%.

Although the Wisconsin authors, on whose work the Michigan standard is partially based, conducted their study to compare survival of 4-, 8-, and 12-inch fingerlings, they did not address the possibility that declining catches may have been due in part to decreasing vulnerability. Inadequate numbers of fish prevented them from making population estimates at one lake and on several occasions at other lakes. No measure of the precision of their estimates was also presented. Sample sizes were also small in Wisconsin. Fewer than 10 age-1 muskies were captured in the fall from 19 of the 24 various groups (3 sizes x 2 years x 4 lakes) and fewer than five age-1 muskies were captured from 16 groups. No fish were caught from half of the groups in spring at age-2.

RECOMMENDATIONS

Based on this assessment, it is recommended that no further electrofishing be conducted to evaluate muskie stockings in Indiana waters using standard electrofishing gear. Likewise, biologists should be cautious in making any significant changes in management strategies based on such small sample sizes. If the Fisheries Section wishes to continue to monitor survival of young muskies, in lieu of delaying muskie population assessments until the fish are vulnerable to large traps, alternative sampling methods should be explored.

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Table 1. Number, age, and catch rate (number per hour) of muskies of captured by electrofishing at 14 Indiana waters from spring 2004 to spring 2006.

LAKE	YEAR	SEASON	TEMP	AGE-1	AGE-2	AGE-3+	HOURS	CPH1	CPH2	CPH3+
Ball	2004	Spring	54	32	10	5	3.00	10.67	3.33	1.67
Ball	2004	Fall	53	2	2	0	1.50	1.33	1.33	0.00
Ball	2005	Spring	61	16	0	2	1.25	12.80	0.00	1.60
Ball	2005	Fall	39	0	0	0	1.25	0.00	0.00	0.00
Ball	2006	Spring	58	14	0	1	1.33	10.53	0.00	0.75
Barbee	2004	Fall	53	1	0	1	2.75	0.36	0.00	0.36
Barbee	2005	Spring	55	2	0	3	2.00	1.00	0.00	1.50
Barbee	2005	Fall	38	1	0	0	4.00	0.25	0.00	0.00
Barbee	2006	Spring	46	0	0	10	2.00	0.00	0.00	5.00
Bass	2004	Spring		41	1	0	1.54	26.62	0.65	0.00
Bass	2005	Spring	44	11	0	1	2.00	5.50	0.00	0.50
Bass	2005	Fall	34	0	0	0	1.91	0.00	0.00	0.00
Bass	2006	Spring	47	15	0	0	2.00	7.50	0.00	0.00
BlackCat	2005	Spring	50	9	np	np	2.00	4.50		
BlackCat	2006	Spring	49	3	0	np	2.30	1.30	0.00	
Bruce	2004	Spring		3	0	2	2.00	1.50	0.00	1.00
Bruce	2004	Fall		2	0	0	2.00	1.00	0.00	0.00
Bruce	2005	Spring		3	0	1	2.00	1.50	0.00	0.50
Bruce	2005	Fall	36	0	0	0	2.00	0.00	0.00	0.00
Glenn Flint	2006	Spring	56	4	np	np	2.00	2.00		
Loon	2004	Fall	53	1	0	0	2.00	0.50	0.00	0.00
Loon	2005	Spring	47	12	1	3	2.00	6.00	0.50	1.50
Loon	2006	Spring	46	5	0	5	2.00	2.50	0.00	2.50
Palestine	2004	Fall		0	0	0	2.00	0.00	0.00	0.00
Palestine	2005	Spring		5	0	0	2.00	2.50	0.00	0.00
Palestine	2006	Spring	65	0	0	1	2.00	0.00	0.00	0.50
Plover	2005	Spring		1	0	4	1.58	0.63	0.00	2.53
Plover	2005	Fall	42	0	0	0	1.93	0.00	0.00	0.00
Plover	2006	Spring	52	0	0	4	1.75	0.00	0.00	2.29
Sandpiper	2005	Spring		1	0	0	0.58	1.72	0.00	0.00
Sandpiper	2005	Fall	44	0	0	0	0.65	0.00	0.00	0.00
Sandpiper	2006	Spring	56	2	0	1	0.61	3.28	0.00	1.64
Skinner	2004	Fall	48	2	1	1	1.13	1.77	0.88	0.88
Skinner	2005	Spring		0	1	3	1.00	0.00	1.00	3.00
Skinner	2006	Spring		3	0	7	1.55	1.94	0.00	4.52
Tippecanoe	2004	Fall	49	0	0	1	2.00	0.00	0.00	0.50
Tippecanoe	2005	Spring		0	0	1	2.00	0.00	0.00	0.50
Waveland	2005	Spring		5	np	np	2.00	2.50		
Waveland	2005	Fall	39	0	np	np	2.00	0.00		
Waveland	2006	Spring	56	2	0	np	2.00	1.00	0.00	
Webster	2004	Fall	46	0	0	5	2.11	0.00	0.00	2.37
Webster	2005	Spring		4	0	14	2.02	1.98	0.00	6.93
Webster	2006	Spring	45	1	0	8	1.64	0.61	0.00	4.88

*np denotes not present in lake.

Table 2. Early records of the number, age, and catch rate (number per hour) of muskies of captured by electrofishing at four Indiana waters.

LAKE	YEAR	SEASON	TEMP	AGE-1	AGE-2	AGE-3+	HOURS	CPH1	CPH2	CPH3+
Bruce	2001	Spring		3	np	np	2.00	1.50		
Bruce	2001	Spring		0	np	np	2.00	0.00		
Bruce	2001	Fall		0	np	np	2.00	0.00		
Bruce	2001	Fall		1	np	np	2.00	0.50		
Bruce	2002	Spring		5	1	np	2.00	2.50	0.50	
Bruce	2003	Fall		3	2	3	2.00	1.50	1.00	1.50
Bruce	2003	Fall		0	0	0	2.00	0.00	0.00	0.00
Loon	1987	Fall	42	0	0	2	2.25	0.00	0.00	0.89
Loon	1988	Spring	49	12	0	0	1.50	8.00	0.00	0.00
Loon	1988	Fall	45	3	0	0	1.50	2.00	0.00	0.00
Skinner	1987	Spring		11	np	np	1.43	7.69		
Skinner	1987	Spring	70	0	np	np	1.50	0.00		
Skinner	1987	Spring	74	2	np	np	1.43	1.40		
Skinner	1987	Spring	79	0	np	np	1.35	0.00		
Skinner	1987	Fall	42	4	np	np	1.35	2.96		
Skinner	1988	Spring	46	8	0	np	1.38	5.80	0.00	
Skinner	1988	Fall	43	4	1	np	1.02	3.92	0.98	
Webster	1998	Fall		1	np	5	2.00	0.50		2.50
Webster	1998	Fall	44	0	np	2	1.00	0.00		2.00

*np denotes not present in lake.